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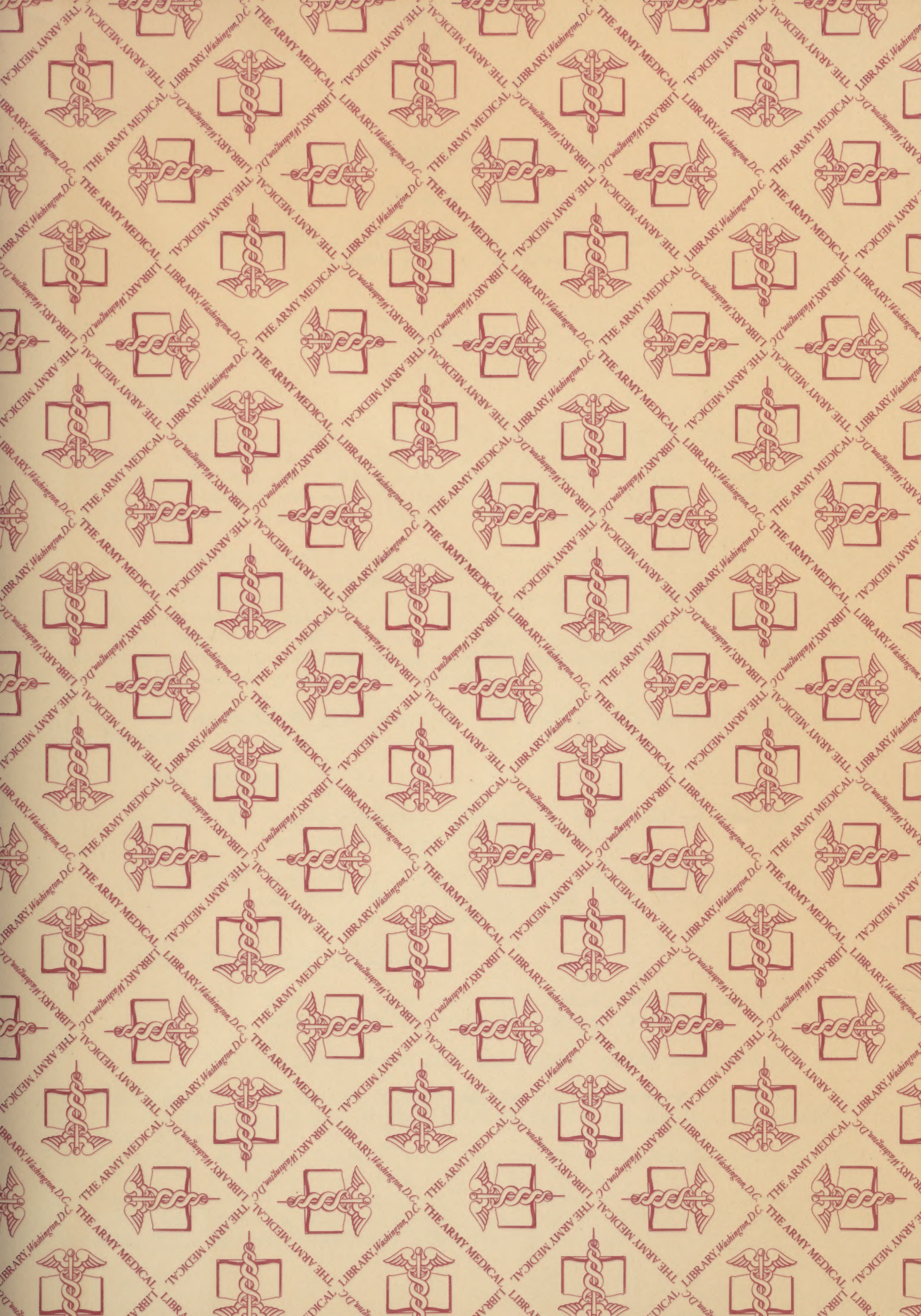
ANALYSIS OF ABDOMINAL CASUALTIES
THAT COMPLETED OPERATION IN CANADIAN
ADVANCED SURGICAL CENTRES IN ITALY
(1 DEC. 44-15 JAN. 45)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ANALYSIS OF ABDOMINAL CASUALTIES

THAT COMPLETED OPERATION

IN CANADIAN ADVANCED SURGICAL CENTRES IN ITALY ★

(1 Dec 44 - 15 Jan 45).

By

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1. INTRODUCTION

A previous report from this laboratory (1), on 179 abdominal cases, recorded a high incidence of death within 24 hours after operation, and emphasized the importance of early post-operative resuscitation. Another report on 640 abdominal and abdomino-thoracic wounds (2), records an even higher incidence of death within the first 24 hours post-operatively.

The present report is an analysis of all abdominal casualties, operated upon in the Advanced Surgical Centres of the First Canadian Corps, 1 Dec 44 to 15 Jan 45. An abdominal casualty has been taken as one in which the peritoneum has been pierced by a missile in the wounding. Thus explorative laparotomies that prove negative are not considered. Likewise, posterior penetrating wounds, producing retro-peritoneal haematomata and possible kidney damage have not been included unless a nephrectomy was done.

The analysis of these cases has been made on the basis of the following factors:

(a) Mortality:

(i) simple abdominal wounds, i.e. those with no other significant wounds other than in the abdomen.

(ii) complicated abdominal wounds, i.e. those in which there are other serious wounds of the chest or extremities in addition to the abdominal lesions.

(b) Wounding to Admission:

(i) time - the time that elapsed from time of wounding to admission to the Advanced Surgical Centre.

(ii) fluids - the fluids administered within this period.

★ Report submitted to the Associate Committee on Army Medical Research, National Research Council of Canada, on 25 March 1945, by No. 1 Research Unit, R.C.A.M.C.

1. Analysis of Abdominal Casualties in Canadian Advanced Surgical Units A.A.I. (23 Aug to 30 Sep 44) - Lt. Col. A.L. CHUTE, O.B.E.
2. Statistical Report on 640 Battle Casualties operated on in the Forward Area C.M.F. for Abdominal and Abdomino-thoracic Wounds.-(1 Jan to 30 Jun 44) - Brig. H.C. Edwards, Consulting Surgeon A.F.H.Q.

(c) Resuscitation (pre-operative)

(i) time - the time spent in the resuscitation wards of the Advanced Surgical Centres.

(ii) fluids - the fluids administered in these resuscitation wards.

(d) Resuscitation (24 hours post-operative)

the fluids administered within this period.

In addition an attempt has been made to assess the actual blood loss of a small group of simple and complicated abdominal wounds, by means of pre-operative blood volume estimations, and to gain thereby some knowledge of the fluid requirements of these patients.

2. FINDINGS

(a) Mortality

There are 90 abdominal cases in the present series operated upon by 5 surgical teams in the Advanced Surgical Centres of the First Canadian Corps.

ABDOMINAL CASUALTIES TABLE I

Post-Operative Mortality Figures

Wounds	Cases	Total Deaths	24 Hour Deaths
Simple	49	17 (35%)	4
Complicated	41	19 (46%)	8
Totals	90	36 (40%)	12

Thirty-six of these 90 cases died in the forward areas, a total post-operative mortality of 40%. Of the deaths, 12 occurred within the first 24 hours, that is 33% of the post-operative deaths occurred within the first 24 hours.

The simple abdominal wounds suffered a mortality of 35%. Four of the 17 deaths in this group occurred within 24 hours of operation.

With the complicated abdominal wounds the mortality was 46%, and 8 of the 19 deaths occurred in the first 24 hours after operation.

(b) Wounding to Admission

(i) Time

The disposition of the formations was such that several F.D.S's alternatively handled the priority I and II casualties for one division whereas a C.C.S. looked after the same priority groups for the other division.

ABDOMINAL CASUALTIES TABLE II

Average Time Spent - Wounding to Admission
(Time in Hours)

	C.C.S.	F.D.S's	Totals
Surviving Cases	5.1	7.1	6.3
Fatal Cases	5.4	6.9	6.1
Totals	5.2	7.0	

The average time from wounding to admission was 7.0 hrs. at the F.D.S's and 5.2 hrs. at the C.C.S. But the average time to admission of all the cases that survived was 6.3 hrs. and for all the fatalities, 6.1 hrs. (Graphs showing the case distribution of the time from wounding to admission are included in the appendix of this report).

(ii) Fluids

Prior to admission to the surgical centres, 48 cases or 53% of the abdominal casualties, received an average of 2.0 bottles of plasma transfusion. Sixty percent of this fluid was given to C.C.S. cases; that is, 74% of the C.C.S. casualties received an average of 1.9 bottles of plasma, whereas only 37% of those evacuated to the F.D.S's received an average of 2.1 bottles of plasma, prior to admission.

(c) Resuscitation (Pre-operative)

(i) Time

ABDOMINAL CASUALTIES TABLE III

Average Time Spent in Resuscitation
(Time in Hours)

	C.C.S.	F.D.S's	Totals
Surviving Cases	5.3	4.9	5.0
Fatal Cases	5.9	4.8	5.4
Totals	5.6	4.8	

The average time spent in the resuscitation ward was 5.6 hours at the C.C.S. compared to 4.8 hours at the F.D.S's. But the average time of all the living cases was 5.0 hrs. and all the fatalities 5.4 hrs. (Graphs showing the case distribution of the time spent in resuscitation are included in the appendix of this report.

(ii) Fluids

In the table the fluids given in the resuscitation wards are reduced, for the sake of simplicity, to the number of 500 cc. bottles of glucose, plasma or blood administered. Protein fluid includes blood, plasma and serum. (For the relative protortions used see Appendix Table II).

ABDOMINAL CASUALTIES TABLE IV

Fluids Given in Resuscitation
Average Number of Bottles Per Patient

Bottle = 500 ccs. of fluid

	C.C.S.		F.D.S's.	
	Total Fluid	Protein Fluid	Total Fluid	Protein Fluid
Surviving Cases	3.7	3.7	2.9	1.9
Fatal Cases	4.4	4.3	3.1	2.4
Totals	4.0	4.0	3.0	2.1

The total fluid per patient given in resuscitation at the C.C.S. was 4.0 bottles (500 cc. each) of which practically all was protein fluid, in other words, blood and plasma. The fatalities received an average of 0.7 bottles more than those that lived, and most of the increase was protein fluid. At the F.D's the total per patient was 3.0 bottles of which 2.1 bottles were protein fluid. The fatalities received on the average 0.2 more bottles of total fluid, but 0.5 more bottles of protein fluid.

Dividing these cases into their primary two groups,

a. simple - wounds primarily of the abdomen,
b. complicated - abdominal wounds with other gross wounds, the averages may be tabled as follows.

ABDOMINAL CASUALTIES TABLE V

Average Number of Bottles Given in Resuscitation
According to Severity of Wounding

	C.C.S.		F.D.S's	
	Total Fluid	Protein Fluid	Total Fluid	Protein Fluid
Simple Wounds	3.6	3.6	2.6	1.7
Complicated Wounds	4.5	4.5	3.5	2.5

(d) Resuscitation (24 hours Post-operatively)

During the first 24 hours post-operatively the C.C.S. and F.D.S. mortality was 32% and 35% respectively. During this period each group administered 5.4 to 5.8 bottles of fluid per patient, of which 2.3 to 2.4 bottles were protein fluids (blood, serum or plasma), and the remainder was glucose saline.

3. BLOOD VOLUME STUDIES

This laboratory has done pre-operative blood volume studies on 32 abdominal cases since 4 Sep 44, of which 17 cases fall within the present period of study, 1 Dec 44 to 15 Jan 45, and have been included in the analysis above. Pre-operative blood volume estimations were done by means of T - 1824 (Evans Blue) on admission to the Advanced Surgical Centres, and the normal blood volume was calculated from the height and weight (and surface area).

(a) Findings of Blood Volume Studies

If these 32 abdominal cases are divided according to their wounds, the blood loss on admission being expressed as a percentage of the calculated normal blood volume in each instance, they appear as follows.

ABDOMINAL CASUALTIES TABLE VI

Admission Blood Volume Loss - Percentage

	Cases	Range	Average
1. Simple abdominal wounds.			
a. Hollow viscus only.	10	0 - 29%	10%
b. Hollow viscus and solid viscus.	4	12 - 24%	16%
c. Solid viscus only.	3	21 - 25%	23%
2. Abdominal wounds with other serious wounds.			
a. Hollow viscus only.	10	1 - 32%	21%
b. Hollow viscus and solid viscus.	3	16 - 36%	26%
c. Solid viscus only.	1	35%	35%

The average percentage blood loss on admission for those cases with simple hollow viscus wounds was 10% of the calculated normal blood volume and for the complicated hollow viscus wounds was 21%. The simple abdominal wounds penetrating a solid as well as a hollow viscus, lost an average of 16%, and the complicated (hollow and solid viscus) an average of 26%.

NOTE: The blood volume estimations on admission to the Surgical centres, do not represent the total blood lost by these patients, as plasma was administered to many of the casualties prior to their admission and in some there appeared to be considerable haemodilution as judged by admission haematocrits.

(b) Discussion of Blood Volume Studies

For the present review, a case is said to be in "good condition" on admission when the clinical picture (peripheral veins, skin temperature of extremities etc.) is satisfactory, the systolic blood pressure is over 100, and the diastolic over 50 mm. Hg. Cases not fulfilling these standards are said to be in "poor condition" on admission.

In reviewing the cases in table VI above in the light of their condition on admission to the Advanced Surgical Centres the following trends may be seen.

1. A simple wound penetrating a hollow viscus only was accompanied by less bleeding than one that also penetrated the superior or posterior abdominal contents, affecting the liver, spleen or kidneys.

2. The simple abdominal wounds that were in fairly good condition, had a blood volume loss of 24% or less with one exception. The simple solid viscus wounds received no forward transfusion and were in each instance, admitted in good condition with a 21% to 25% blood loss.

3. With the complicated abdominal wounds, there was not such a direct correlation, but of course, the extra-abdominal wounds in these cases varied considerably. Generally it may be said that in the present short series if they arrived in poor condition, they had a greater than a 30% blood loss, and if in good condition less than 20%, and that they averaged approximately 22% blood loss on admission.

4. In terms of blood substitutes, 1 bottle of blood plus 1 bottle of plasma represent 12.5% of the blood volume of an average man (5600 cc.). Seldom is there greater than 30% blood loss on admission to a resuscitation ward. Few abdominal wounds therefore will require more than four bottles of protein fluid i.e. blood and plasma.

4. DISCUSSION

The gross mortality of abdominal wounds in the forward areas remains relatively unchanged; 40% in the present series compared to 39% reported by Lt.-Col. Chute. But the mortality within 24 hrs. of operation has dropped from 50% of the total deaths in the previous series, to 33% in the present.

The drop in the 24 hour mortality may be due to increased post-operative care. For instance, the blood pressure was recorded in many instances, every hour for the first 24 hours, indicating that the patients were at least seen every hour throughout the early post-operative period, and any vascular collapse could be recognized early in it's onset. The net result has been a prolongation of life by increased care, rather than a saving of life.

There is almost a 2 hour difference in the time from wounding to admission to the Advanced Surgical Centre in the two divisions, but there is no appreciable difference in the time taken by the fatalities as compared to the living cases in either division, or in the corps as a whole.

The average time spent in resuscitation in the C.C.S. was 5.6 hrs. and at the F.D.S's 4.8 hrs. These periods of time are in excess of the time actually required for resuscitation, as during heavy fighting, the casualties may have to wait 1 - 2 hrs. in resuscitation for their turn in the operating theatre.

By the blood volume studies the simple abdominal wounds seldom suffer a blood loss in excess of 30% of the normal, and average at 13%. This represents 2 bottles of protein fluid. The simple abdominal casualties at the F.D.S's were given an average of 1.7 bottles of protein fluid and at the C.C.S., 3.6 bottles. (Table V). The preponderance of protein fluids at the C.C.S. indicates a sparing use of glucose saline however the F.D.S's gave 1.1 bottles on the average to each patient.

For both divisions the fatalities received 0.5 bottles of protein fluid more than the living cases but the difference in time spent in resuscitation was not significant.

5. CONCLUSIONS

1. An analysis has been made of 90 abdominal casualties exclusive of negative laparotomies, operated upon by 5 Surgical Teams in the Advanced Surgical Centres of the First Canadian Corps., from 1 Dec 44 to 15 Jan 45.

2. The gross mortality in the forward areas was 40%, 1/3 of which (33%) died within the first 24 hours after operation.

3. The mortality was 35% in the simple abdominal cases (without other serious wounds) and 46% in the abdominal cases complicated by other serious wounds.

4. There was no significant difference in the average time spent from wounding to admission to the surgical centres, between the fatalities and the living cases (6.1 hrs. and 6.3 hrs. respectively).

5. Fifty-three percent of abdominal casualties received an average of 2.0 bottles of plasma, prior to admission.

6. The average time spent by these casualties in the resuscitation wards

was perhaps excessive (4.8 hours to 5.6 hours average) but there was no significant difference between the fatalities and the living cases.

7. In some cases there is a tendancy to over transfuse with protein fluids in the resuscitation wards coupled with a sparing use of glucose saline.

8. Pre-operative blood volume studies have been made on 32 abdominal cases (17 in the above series) to judge the amount of transfusion fluids required by these casualties.

9. Simple penetrating abdominal wounds arriving in the resuscitation wards in good condition, have a probable blood loss of 24% or less, and require a maximum of 2 bottles of blood and 1 of plasma. Any further administration of intravenous fluid should be glucose saline. The same casualty arriving in poor condition probably requires at least 2 bottles of each of blood and plasma.

10. The blood loss in the complicated abdominal wounds varied according to the severity of the extra-abdominal wounds as well as the intra-abdominal lesions, thus generalizations as to blood volume loss in these patients is not warranted. In general their blood volume reduction was greater than for the corresponding simple abdominal lesion.

ABDOMINAL CASUALTIES THAT COMPLETED OPERATION IN CANADIAN ADVANCED SURGICAL CENTRES

IN ITALY - 1 Dec 44 - to 15 Jan 45.

APPENDIX - TABLE I

MORTALITY FIGURES AND PERCENTAGES

	All Cases (Excluding negative laparotomies)			Simple group (No other Significant Wounds)			Complicated Group (Other Gross Wounds)		
	Cases	Total Deaths	24 Hr. Deaths	Cases	Total Deaths	24 Hr. Deaths	Cases	Total Deaths	24 Hr. Deaths
Special Group	22	5	2	13	2	1	9	3	1
F.D.S.	29	12	4	16	5	2	13	7	2
F.D.S. Totals	51	17 33%	6 35%	29 57%	7 24%	3	22 43%	10 45%	3
C.C.S.	39	19 49%	6 32%	20 51%	10 50%	1	19 49%	9 47%	5
Grand Totals	90	36 40%	12 33%	49 54%	17 35%	4	41 46%	19 46%	8

ABDOMINAL CASUALTIES THAT COMPLETED OPERATION IN CANADIAN ADVANCED SURGICAL CENTRES

IN ITALY - 1 Dec 44 to 15 Jan 45.

APPENDIX - TABLE II

Fluids Given in Resuscitation

		Glucose		Plasma		Blood		Total Average	
		No. Patients	No. of 500 cc Bottles	No. Patients	No. of 500 cc Bottles	No. Patients	No. of 500 cc Bottles	Total Fluid	Protein Fluid
F.D.S's	Living	22	34	24	31	24	34	99/34 = 2.9	65/34 = 1.9
	Deaths	9	12	11	19	13	22	53/17 = 3.1	41/17 = 2.4
	Totals	31	46	35	50	37	56	152/51 = 3.0	106/51 = 2.1
	Average		1.5		1.4		1.5		
	Living	0	0	17	33	17	41	74/20 = 3.7	74/20 = 3.7
	Deaths	1	2	16	34	17	47	83/19 = 4.4	81/19 = 4.3
	Totals	1	2	33	67	34	88	157/39 = 4.0	155/39 = 4.0
	Average		2.0		2.0		2.6		

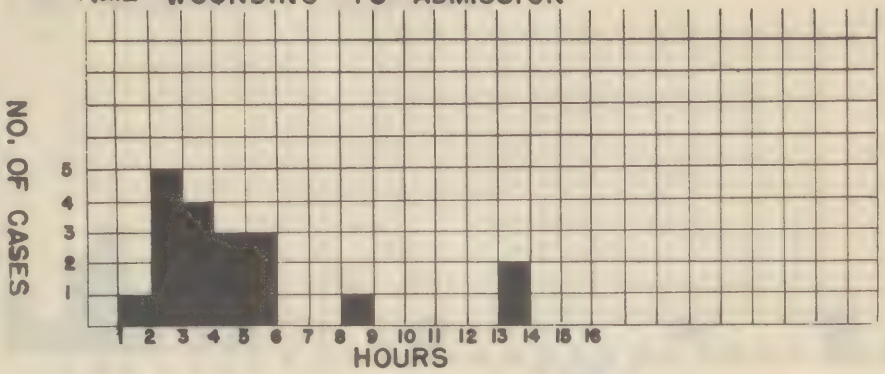
ABDOMINAL CASUALTIES THAT COMPLETED OPERATION IN CANADIAN ADVANCED SURGICAL CENTRES IN ITALY (1 DEC 44-15 JAN 45)

APPENDIX - GRAPH I

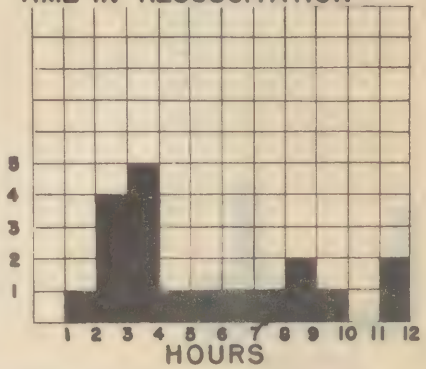
C.C.S. CASES

FATAL CASES

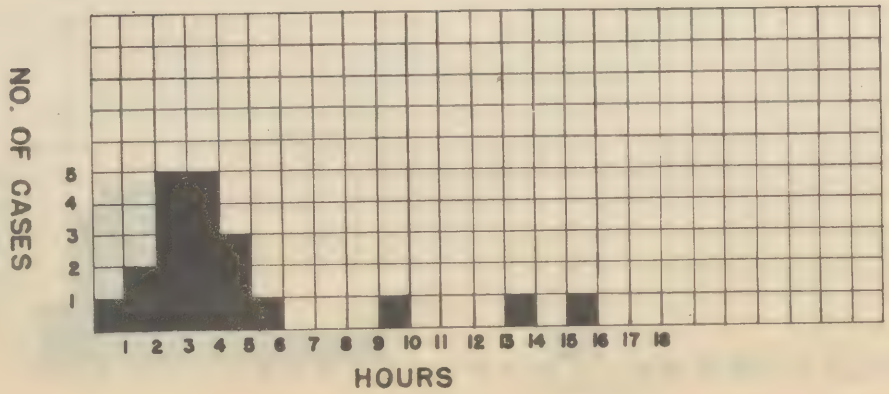
TIME - WOUNDING TO ADMISSION

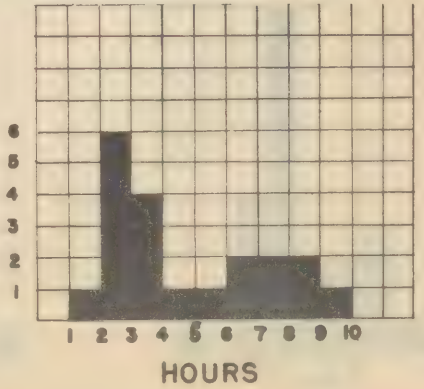


TIME IN RESUSCITATION



SURVIVING CASES





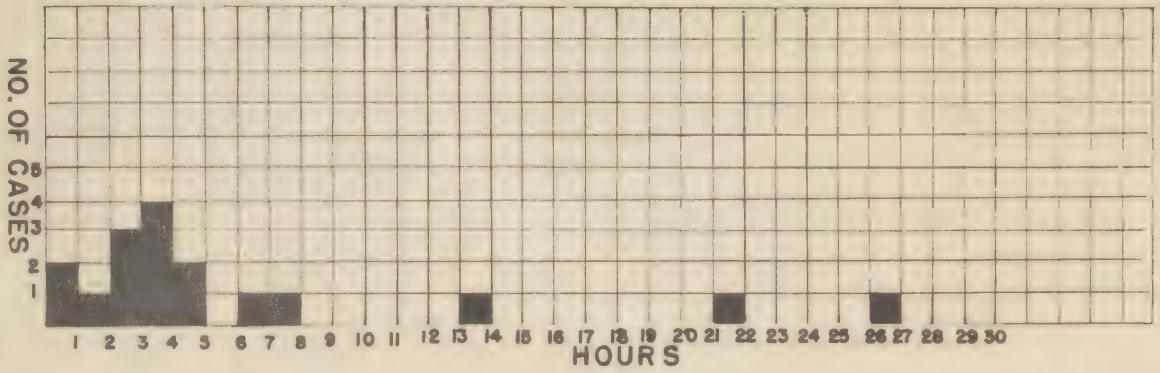
ABDOMINAL CASUALTIES THAT COMPLETED OPERATION IN CANADIAN ADVANCED SURGICAL CENTRES IN ITALY (1 DEC 44-15 JAN 45)

APPENDIX-GRAPH II

F.D.S. CASES

FATAL CASES

TIME - WOUNDING TO ADMISSION



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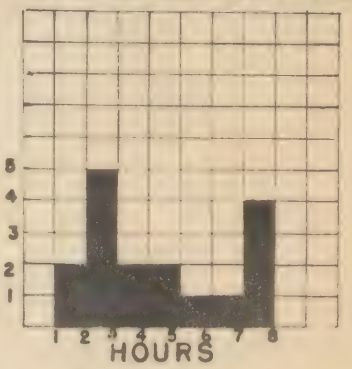

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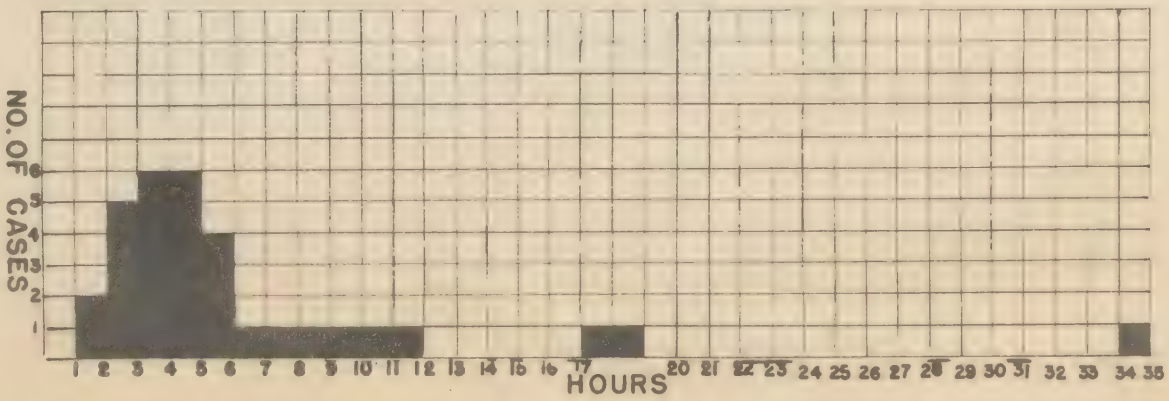

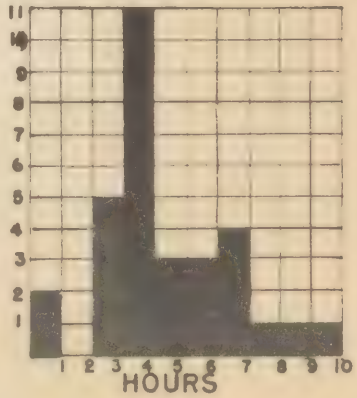

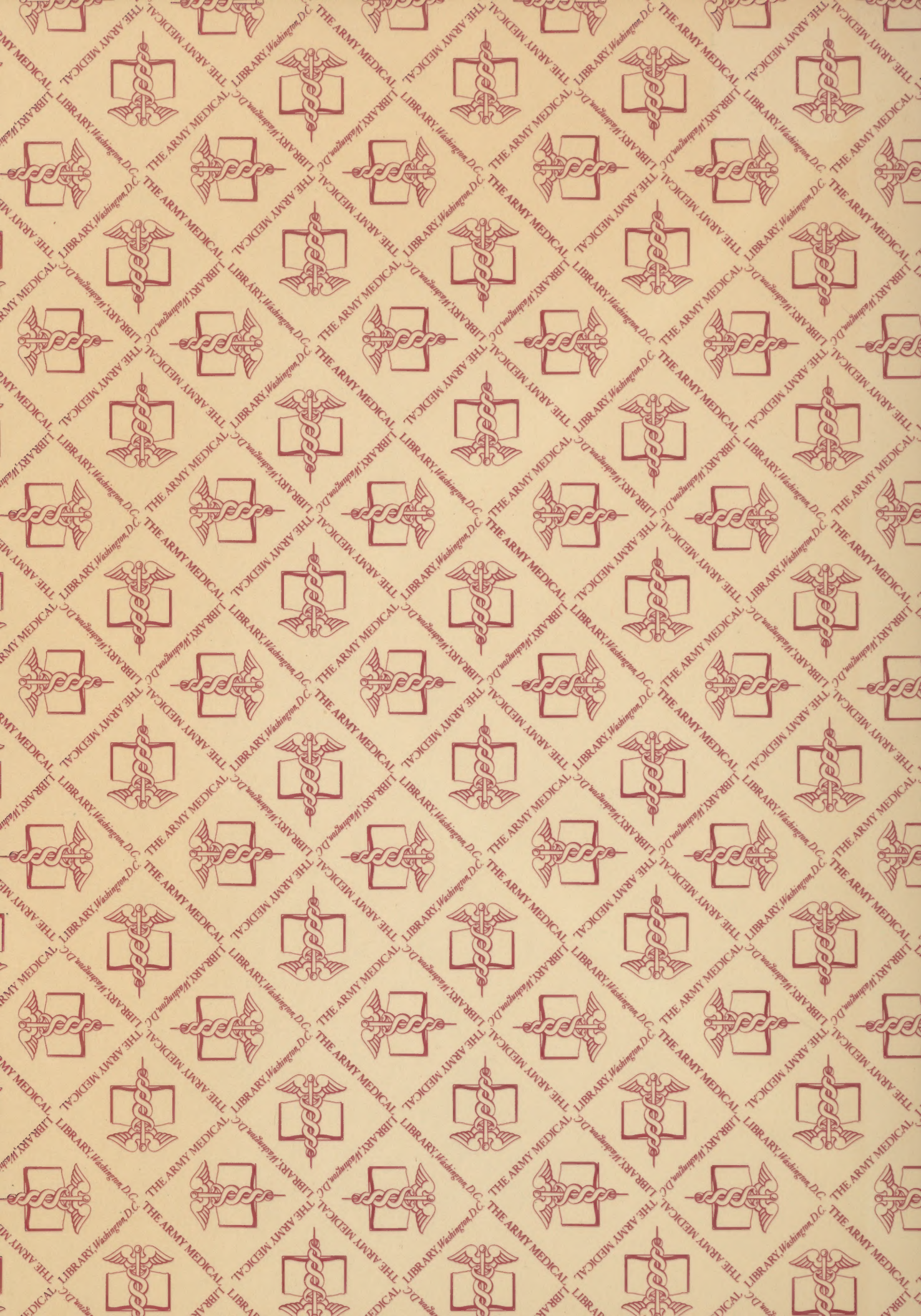
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